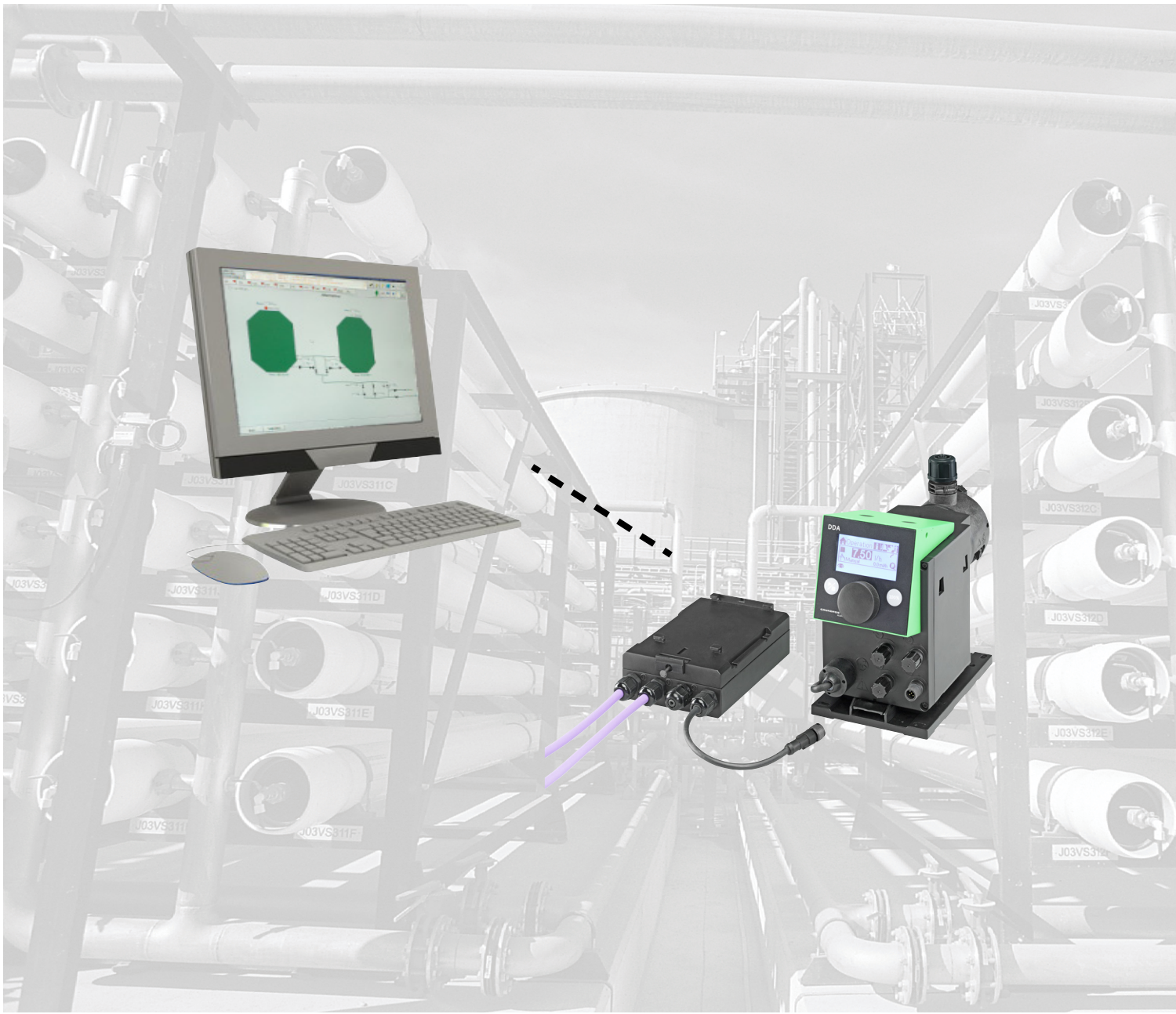
PROFIBUS and PROFINET for Digital Dosing

CIM 150 PROFIBUS DP
CIM 500 Ethernet for PROFINET IO

Functional profile and user manual



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Original functional profile and user manual.

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1. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury.

Caution ***If these safety instructions are not observed, it may result in malfunction or damage to the equipment.***

Note ***Notes or instructions that make the job easier and ensure safe operation.***

2. Introduction

2.1 About this functional profile

This functional profile describes the:

- CIM 150 PROFIBUS DP
- CIM 500 Ethernet for PROFINET IO.

for PROFIBUS DP and PROFINET IO communication with the Smart Digital Dosing pump, type DDA, referred to as "DDA pump" in the following.

The data in this document are subject to change without prior notice. Grundfos cannot be held responsible for any problems caused directly or indirectly by using information in this functional profile.

2.2 PROFIBUS DP-V0

The PROFIBUS DP interface conforms to the PROFIBUS DP-V0 standard for cyclic data transmission.

The option of setting the PROFIBUS DP address via bus is not supported as the CIM 150/500 has two switches for setting the address.

2.3 PROFIBUS DP-V1

Only the diagnostic part and the extra three bytes of parameterisation data are supported. Acyclic data transmission is not supported.

2.4 Assumptions

This functional profile assumes that the reader is familiar with commissioning and programming of PROFIBUS and PROFINET devices.

2.5 Definitions and abbreviations

ARP	Address Resolution Protocol. Translates IP-addresses to MAC-addresses
Auto-MDIX	Ensures that both crossover cable types and non-crossover cable types can be used.
CAT5	Ethernet cable type: Has 4 twisted pairs of wires.
CAT5e	Enhanced CAT5 cable with better performance.
CAT6	Cable with very high performance.
CIM	Communication Interface Module.
CRC	Cyclic Redundancy Check, a data error detection method.
DHCP	Dynamic Host Configuration Protocol. Used to configure network devices so that they can communicate on an IP network.
DNS	Domain Name System. Used to resolve host names to IP addresses.
Enumeration	List of values.
GENIbus	Proprietary Grundfos fieldbus standard.
GENIpro	Proprietary Grundfos fieldbus protocol
Grundfos GO	A Grundfos handheld remote control device for controlling Grundfos products via infrared or radio. Based on smart phone technology.
H	Pressure (Head).
HTTP	Hyper Text Transfer Protocol. The protocol commonly used to navigate the world wide web.
IANA	Internet Assigned Numbers Authority.
IP	Internet Protocol
LED	Light-Emitting Diode.
Local mode	The DDA pump uses the setpoint and operating mode set with a handheld remote control (R100 or Grundfos GO Remote) or by the use of buttons on the pump.
MAC	Media Access Control. Unique network address for a piece of hardware.
Ping	Packet InterNet Groper. A software utility that tests connectivity between two TCP/IP hosts.
Q	Flow.
R100	Grundfos handheld infrared remote control.
Remote mode	The DDA pump uses the setpoint and operating mode set from the fieldbus.
SELV	Separated or Safety Extra-Low Voltage.
SELV-E	Separated or Safety Extra-Low Voltage with Earth connection.
SMA	SubMiniature version A. Coaxial radio signal cable connection standard.
SMTP	Simple Mail Transfer Protocol
SNTP	Simple Network Time Protocol. Used for clocks synchronization between computer systems.
TCP	Transmission Control Protocol. Protocol suitable for Internet communication and Industrial Ethernet communication.
TCP/IP	Transmission Control Protocol/Internet Protocol. Protocol suitable for Internet communication.
Transmission speed	Bits transferred per second, bits/s.
URL	Uniform Resource Locator. The address used to connect to a server.
UTC	ICoordinated Universal Time, the primary time standard by which the world regulates clocks and time.
UTF-8	Unicode Transformation Format (character encoding).
DDA	Digital Dosing Advanced
HMI	Human Machine Interface, display and buttons on the DDA pump.
PLC	Programmable Logic Controller

3. System description

The system diagram provide an overview for the two different technologies of how to connect the CIM module to the Grundfos DDA E-box that is to be connected to a PROFIBUS DP or PROFINET IO network.

The CIM 150/500 is a communication module to be installed internally in the Grundfos DDA E-box, using a 10-pin connection. In this setup, the E-box will supply power to the CIM. See fig. 1.

For mounting of the CIM module, see the installation and operating instructions for the DDA E-box.

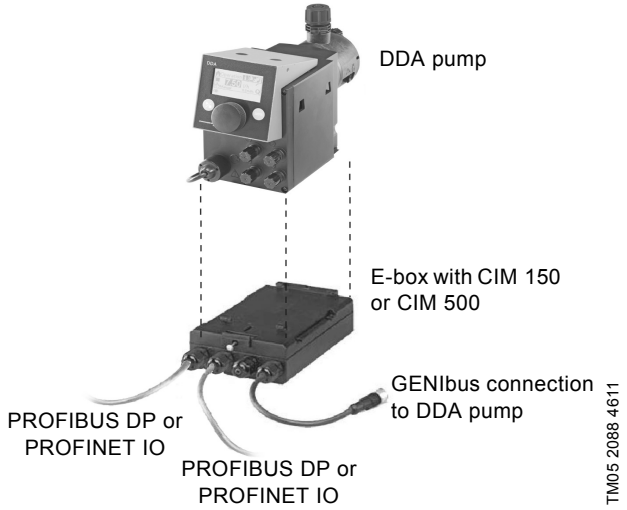

Fig. 1 DDA pump with E-box connected to a daisy chained PROFIBUS/PROFINET network

4. Specifications

4.1 CIM module general data

General data	Description	Comments
Ambient humidity	30 % to 95 %	Relative, non-condensing.
Operating temperature	-20 °C to +45 °C	
Storage temperature	-25 °C to +70 °C	
GENIbus visual diagnostics	LED2	Will be in one of these states: Off, constantly green, flashing red, constantly red. See section *5.6* for PROFIBUS DP and section *6.5* for PROFINET IO.

4.2 CIM 150 PROFIBUS DP

The table below provides an overview of the specifications for the Grundfos CIM 150. For further details, please refer to the specific sections of this functional profile.

General data	Description	Comments
PROFIBUS implementation class	DP-V0	Intelligent pump profile.
PROFIBUS connector	Screw-type terminal	A, B, DGND, VP (+5 V).
PROFIBUS connection type	RS-485, two-wire	Conductors: A, B.
Maximum cable length	100 metres at 12 Mbits/s	Corresponds to 328 feet. See section *5.3.1 Data transmission rates and cable length*.
Slave address	1-126	Set via rotary switches SW3 and SW4. See section *5.4 Setting the PROFIBUS address*.
Line termination	On or off	Set via DIP switches SW1 and SW2. See section *5.5 Termination resistors*. Auto detected
Recommended cable cross sectional cobber area	0.20 - 0.25 mm^2	AWG24 or AWG23
Supported transmission speed	9.6 Kbits/s to 12 Mbits/s	Auto detected.
PROFIBUS visual diagnostics	LED1	Off, constantly green, flashing red, constantly red. See section *5.6 Status LEDs*.
Maximum number of PROFIBUS devices at a physical network segment	32	Up to 125 devices if repeaters are used (physically segmented network).

4.3 CIM 500 PROFINET IO

The table below provides an overview of the specifications for the Grundfos CIM 500 Ethernet for PROFINET IO. For further details, please refer to the specific sections of this functional profile.

Modbus TCP specifications	Description	Comments
Application layer	DHCP, HTTP, Ping, FTP, SMTP, SNTP, PROFINET IO	Rotary switch in position 0.
Transport layer	TCP	
Internet layer	Internet protocol V4 (IPv4)	
Link layer	ARP, Media Access Control (Ethernet)	
Ethernet cable	Screened/unscreened, twisted-pair cables, CAT5, CAT5e or CAT6	Supports auto cable-crossover detecting (Auto-MDIX).
Maximum cable lenth	100 metres at 10/100 Mbits/s	Corresponds to 328 feet.
Transmission speed	10 Mbits/s, 100 Mbits/s	Auto-detected.
Industrial Ethernet protocols	PROFINET IO, Modbus TCP	Selected with rotary switch, section 6.2.

5. PROFIBUS DP, CIM 150 setup

5.1 PROFIBUS bus topology

The PROFIBUS-preferred bus topology is daisy chaining as illustrated in fig. 2. The end devices of a physical bus segment must be terminated (LT = Line Termination). Each device must have a unique physical address [1-126]. Up to 32 PROFIBUS devices can be connected to a bus segment, and by using a repeater another 32 devices can be connected. This can be repeated until the maximum number of addresses are used. Make sure that each device is connected to a proper earth potential.

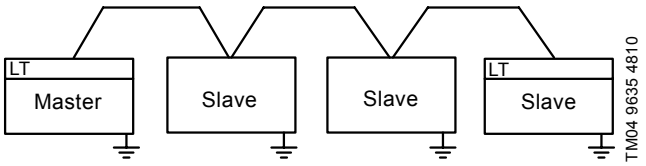

Fig. 2 Example of PROFIBUS bus segment with line termination

5.2 CIM 150 PROFIBUS module

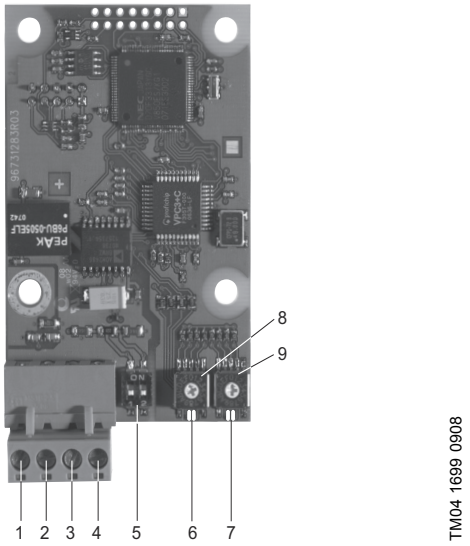

Fig. 3 CIM 150 PROFIBUS module

Pos.	Designation	Description
1	B (RxD/TxD-P)	PROFIBUS terminal B (positive data signal)
2	A (RxD/TxD-N)	PROFIBUS terminal A (negative data signal)
3	DGND	PROFIBUS terminal DGND (only for external termination)
4	VP	+5 VDC (only for external termination)
5	SW1/SW2	On/off switches for termination resistors
6	LED1	Red/green status LED for PROFIBUS communication
7	LED2	Red/green status LED for GENIbus communication between the CIM 150 and the DDA pump
8	SW3	Not used for DDA
9	SW4	Not used for DDA

Note ***The power supply (pos. 4, fig. 3) must only be used for external termination.***

5.3 Connecting the PROFIBUS

5.3.1 Data transmission rates and cable length

Grundfos recommends to use a cable according to IEC 61158.

Example

Siemens, 6XV1 830-0EH10.

Cable length

Kbits/s	Maximum cable length [m/ft]
9.6	1200/4000
19.2	1200/4000
45.45	1200/4000
93.75	1000/3300
187.5	1000/3300
500	400/1300
1500	200/660
3000	100/330
6000	100/330
12000	100/330

Fitting the cable

See fig. 4.

1. Connect the red conductor(s) to terminal B (pos. 1).
2. Connect the green conductor(s) to terminal A (pos. 2).
3. Connect the cable screens to earth via the earth clamp (pos. 3).

Note ***For maximum safety and reliability, connect the cable screen to earth via the earth clamp, and make sure that all CIM 150 units are properly earthed via the mains supply earth wire.***

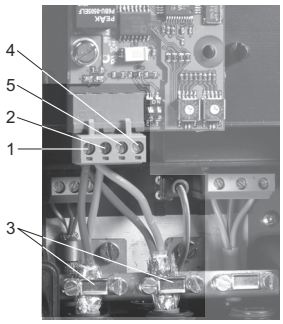

Fig. 4 Connecting the PROFIBUS

Pos.	Description
1	PROFIBUS terminal B
2	PROFIBUS terminal A
3	Earth clamp
4	+5 VDC
5	DGND

5.4 Setting the PROFIBUS address

The PROFIBUS address is selected via the menu system in the pump display.

Note ***The PROFIBUS address must be set decimally from 1 to 126. The address 126 is normally used for special purposes and should not be used.***

A restart of the CIM 150 has to be performed for a PROFIBUS address change to take effect.

For complete overview of the PROFIBUS addresses, see section *11. PROFIBUS address*.

5.5 Termination resistors

The termination resistors are fitted on the CIM 150 PROFIBUS module. See fig. 5.

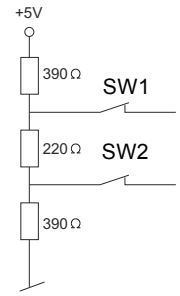

Fig. 5 Internal termination resistors

The CIM 150 has a DIP switch with two switches (SW1 and SW2) for cutting the termination resistors in and out. Figure 6 shows the DIP switches in cut-out state.

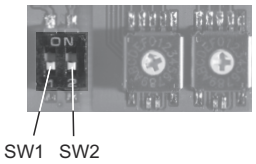

Fig. 6 Cutting termination resistors in and out

DIP switch settings

Status	SW1	SW2
Cut in	ON	ON
Cut out	OFF	OFF
Undefined state	ON	OFF
	OFF	ON

Note ***To ensure stable and reliable communication, it is important that only the termination resistors of the first and last units in the PROFIBUS network are cut in.***

5.6 Status LEDs

The CIM 150 PROFIBUS module has two LEDs. See fig. 3.

- Red/green status LED (LED1) for PROFIBUS communication.
- Red/green status LED (LED2) for GENIbus communication between the CIM 150 and the connected DDA pump.

LED1

Status	Description
Off.	The CIM 150 has been switched off.
Constantly green.	The CIM 150 is ready for PROFIBUS data transmission (Data Exchange State).
Constantly red.	CIM 150 module fault. The CIM 150 does not support the connected DDA pump.
Flashing red.	Wrong or missing PROFIBUS configuration or no contact to the PROFIBUS master.

LED2

Status	Description
Off.	The CIM 150 is switched off.
Constantly green.	GENIbus communication between the CIM 150 and the DDA pump is OK.
Constantly red.	The CIM 150 does not support the connected DDA pump.
Flashing red.	No GENIbus communication between the CIM 150 and the DDA pump.

Note ***During start-up, there may be a delay of up to 5 seconds before the LED2 status is updated.***

5.7 Communication watchdog

The state of the PROFIBUS communication watchdog can be changed with a PROFIBUS commissioning tool, e.g. Siemens Simatic Manager. If the watchdog is enabled, all bits in the ControlModule (see section *7.2 Control module (ControlModule, module 1)*) are automatically set to "0" if the PROFIBUS communication is broken.

As a result, the DDA pump will be set to local mode and then be operating according to the local operating mode, local setpoint and local control mode.

5.8 Reaction to PLC "Stop button"

If the PLC is stopped by the operator, all output registers will be set to "0".

As a result, the control bit RemoteAccessReq will be cleared, and the DDA pump will be set to local mode and then be operating according to the local operating mode, local setpoint and local control mode.

6. PROFINET IO, CIM 500 setup

6.1 Connecting the Ethernet cable

Warning

The CIM 500 must only be connected to SELV or SELV-E circuits.

RJ45 plugs and Ethernet cable must be used. The cable shield must be connected to protective earth at both ends.

Note

It is important to connect cable shield to earth through earth clamp or to connect cable shield to earth in the connector.

The CIM 500 is designed for flexible network installation; the built-in two port switch makes it possible to daisy chain from product to product without the need of additional Ethernet switches. The last product in the chain is only connected to one of the Ethernet ports. Each Ethernet port has its own MAC address.

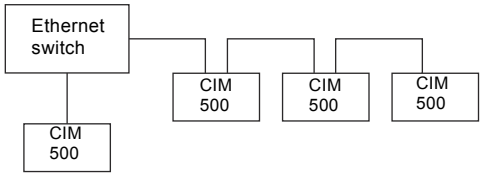

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Fig. 7 Example of Industrial Ethernet network

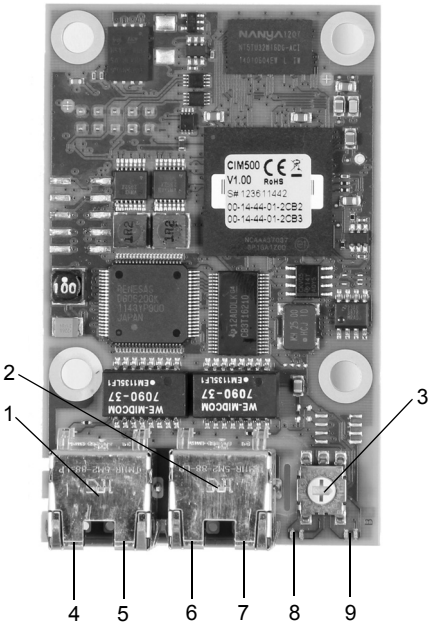

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Fig. 8 Example of Ethernet connection (CIM 500)

Pos.	Description	Designation
1	Industrial Ethernet RJ45 Connector 1	ETH1
2	Industrial Ethernet RJ45 Connector 2	ETH2
3	Rotary switch for protocol selection	SW1
4	Data activity LED for Connector 1	DATA1
5	Link LED for Connector 1	LINK1
6	Data activity LED for Connector 2	DATA2
7	Link LED for Connector 2	LINK2
8	Green/red status LED for Ethernet communication	LED 1
9	Green/red status LED for internal communication between module and pump.	LED 2

6.2 Setting the Industrial Ethernet protocol

The CIM 500 Ethernet module has a rotary switch for selection of the Industrial Ethernet protocol. See fig. 9.

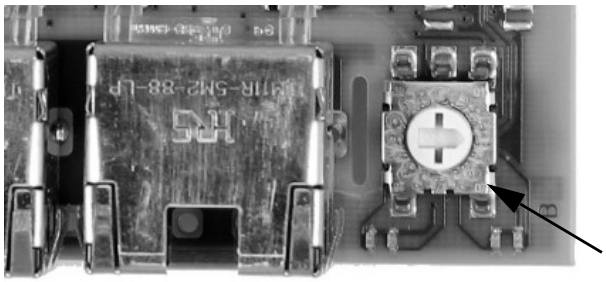

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Fig. 9 Selecting the Industrial Ethernet protocol

Pos.	Description
0	PROFINET IO (Default from factory)
1	Modbus TCP
2..E	Reserved, LED1 will be permanently red to indicate an invalid configuration
F	Reset to factory default Note: The rotary switch has to be set in this position for 20 seconds before the CIM 500 resets to factory default. During this period LED1 will be flashing red and green at the same time to indicate that a reset will occur.

Note

Every change of the rotary switch, when the module is powered on, will cause the module to restart.

6.3 Setting up the IP-addresses

The CIM 500 Ethernet module is default set up to a fixed IP address. It is possible to change the IP address settings from the built in web server.

Default IP settings used by web server	IP address:192.168.1.100 Subnet mask: 255.255.255.0 Gateway: 192.168.1.1
IP-settings for Modbus TCP	Must be setup by the Web server
Device name and IP settings for PROFINET IO	Static configuration from Web server or configuration from PROFINET IO configuration tool.

6.4 Establish connection to the Webserver

The CIM 500 module can be configured using the built-in Web server. To establish a connection from a PC to CIM 500 the following steps are required:

- Connect the PC and the CIM 500 module using an Ethernet cable
- Configure the PC Ethernet port to the same subnetwork as the CIM 500, e.g. 192.168.1.101, and the subnet mask to 255.255.255.0. See section *A.2 Web server configuration* on page 28.
- Open a standard Internet browser and type 192.168.1.100 in the URL field.
- Log in to the Web server using:

User	admin (default)
Password	Grundfos (default)

Note ***User and password may have been changed from their factory default values.***

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Fig. 10 CIM 500 connected to PC

Note ***Both ETH1 and ETH2 can be used to establish a connection to the Web server.***

Note ***The web server can be accessed while the selected Industrial Ethernet protocol is active.***

6.5 Status LEDs

The CIM 500 Ethernet module has two Status LEDs, (LED1 and LED2).

See fig. 8.

- Red/green status LED (LED1) for Ethernet communication
- Red/green status LED (LED2) for internal communication between the CIM 500 and the Grundfos product.

LED1

Status	Description
Off	The CIM 500 is switched off.
Flashing green	Wink function. LED will flash 10 times when activated from master.
Permanently green	The CIM 500 is ready for data transmission (data exchange state).
Flashing red (3 Hz, duty cycle 50 %)	Wrong or missing PROFINET IO configuration. See section *9.2.1 LED status*.
Pulsing red (0.3 Hz, duty cycle 10%)	Configured, but connection to master lost. See section *9.2.1 LED status*.
Permanently red	Product not supported. See section *9.2.1 LED status*.
Permanently red and green	Error in firmware download. See section *9.2.1 LED status*.
Flashing red and green	After 20 seconds in this state, the CIM 500 factory settings are restored and the device is restarted.

LED2

Status	Description
Off	The CIM 500 is switched off.
Flashing red	No internal communication between the CIM 500 and the Grundfos product.
Permanently red	The CIM 500 does not support the Grundfos product connected.
Permanently green	Internal communication between the CIM 500 and the Grundfos product is OK.
Permanently red and green	Memory fault.

Note ***During start-up, there is a delay of up to 5 seconds before LED1 and LED2 status is updated.***

6.6 DATA and LINK LEDs

The CIM 500 Ethernet module has two connectivity LEDs related to each RJ45 Connector. See fig. 8.

DATA1 and DATA2

These yellow LEDs indicate data traffic activity.

Status	Description
Yellow off	No data communication on RJ45 Connector.
Yellow flashing	Data communication ongoing on RJ45 Connector.
Steady yellow	Heavy network traffic on RJ45 connector.

LINK1 and LINK2

These green LEDs shows whether the ethernet cable is properly connected.

Status	Description
Green off	No Ethernet Link on RJ45 Connector
Green on	Ethernet Link on RJ45 Connector is OK

7. Detailed description of data modules

7.1 Data types

The Grundfos CIM 150/500 supports the following data types.

All data types, except for data type 10, comply with specification IEC 61158-6 standard data types for use in PROFIBUS/ PROFINET profiles.

Data type	Description
1	Boolean
2	Integer 8
3	Integer 16
4	Integer 32
5	Unsigned 8
6	Unsigned 16
7	Unsigned 32
8	Floating point
9	Visible string
10	Non-standard

All multi-byte data types are transmitted with MSB (Most Significant Byte) first.

7.1.1 Explanation to event trigger

State

Control bits with a state event trigger behave like a "state" that is forced upon the DDA pump. The CIM 150/500 will attempt to make the pump operate according to the "requested" state in the ControlModule. Due to certain state/mode restrictions, this might not always be possible (see explanation to the bit in question). The "actual state" of the pump can be read from the corresponding bit in StatusModule (module 11).

Value change

Control bits/bytes with a value-change event trigger behave like a command that is executed when the bit/byte changes its value. The CIM 150/500 will attempt to make the DDA pump operate according to the "requested" value in the ControlModule. The change will be reflected in the corresponding bit/byte in StatusModule (module 11). Bits/bytes that are controlled by a "value-change event trigger" can be controlled from both PROFIBUS/PROFINET and the pump HMI. The last value change, no matter from which source, will become active if not prevented by other conditions (see explanation to the bit/byte in question).

Rising edge

Control bits with a rising-edge event trigger behave like a command that is executed when a bit transition from "0" to "1" occurs. Each of them has a corresponding acknowledge bit in the StatusModule (module 11) which is set when the command is executed and cleared when the control bit is written back to "0".

7.2 Control module (ControlModule, module 1)

This is a PROFIBUS/PROFINET output module used for the control of the DDA pump. Its data type is 10, non-standard.

Mode/state settings

	Bit	Name	Event trigger
Byte 1 (data type 5)	0	RemoteAccessReq	State
	1	Deaerating (100 %)	Value change
	2	AnalogMode	Value change
	3	TimerMode	Value change
	4	SlowMode	Value change
	5	Velocity	Value change
	6-7	-	-

Enable/disable function

	Bit	Name	Event trigger
Byte 2 (data type 5)	0	AutoDeaeratingEnable	Value change
	1	FlowControlEnable	Value change
	2	ProfiWatchdogEnable	Value change
	3	AutoFlowAdaptEnable	Value change
	4	PulseMemoryEnable	Value change
	5-7	-	-

Action commands

	Bit	Name	Event trigger
Byte 3 (data type 5)	0	ResetFault	Rising edge
	1	Pulse	Rising edge
	2	ResetVolumeCounter	Rising edge
	3	SetRTC	Rising edge
	4-7	-	-

ReqStartStop [enumeration]
Triggered by value change

	Value	Name
Byte 4 (data type 5)	0	ReqStart
	1	ReqStop
	2-255	-

OperatingMode [enumeration]
Triggered by value change

	Value	Name
Byte 5 (data type 5)	0	Manual
	1	Pulse
	2	Analog
	3	Timer
	4	Batch
	5-255	-

7.2.1 Explanation to control bits in ControlModule

RemoteAccessReq

Control bit used by the CIM 150/500 to activate control from the bus.

0:	The pump can only be controlled via the pump HMI and from its external signal inputs. With this setting, all control bits in ControlModule and writing to any output module will have no influence.
1:	The CIM 150/500 can control the pump according to the settings in the ControlModule and the writing to the other output modules. The pump can also be controlled via the pump HMI and from its external signal inputs.

Deaerating

Control bit used to start and stop deaerating the pump.

0:	Stop deaerating the pump.
1:	Start deaerating the pump. Equivalent to keep pressing 100%.

If the pump has been stopped via the pump HMI (symbol ■), it is still possible to start and stop deaerating the pump from the bus.

If deaerating of the pump has been started from the bus, it can be stopped by pressing 100% or ▶/■ on the pump.

AnalogMode

Control bit used to select type of analog input signal.

0:	0-20 mA.
1:	4-20 mA.

The toggling of this bit has no effect unless the pump is in operating mode "Analog". The actual state (readable from StatusModule) will be reset to 4-20 mA whenever another operating mode is selected.

TimerMode

Control bit used to select timer mode.

0:	Cycle timer mode. The pump repeats a cyclical dosing of the batch volume which can be programmed from PROFIBUS/PROFINET with data modules SetBatchDosingVolume and SetBatchDosingTime.
1:	Week timer mode. Up to 16 time-controlled dosing procedures are defined for a week. These procedures have to be programmed via the pump HMI.

SlowMode

Control bit used to slow down the suction stroke velocity.

0:	SlowMode disabled. No slow-down of suction stroke velocity.
1:	SlowMode enabled. Slows down the suction stroke velocity to the velocity selected with control bit Velocity.

Velocity

Control bit used to select SlowMode suction stroke velocity.

0:	Select SlowMode velocity 50 %.
1:	Select SlowMode velocity 25 %.

The toggling of this bit has no effect unless the pump operates in SlowMode. Will be reset to 50 % velocity whenever SlowMode is disabled.

AutoDeaeratingEnable

0:	Automatic pump deaeration disabled.
1:	Automatic pump deaeration enabled. The pump is automatically deaerated (degassed) at regular intervals.

Data module 34 DigitalOutputs, bit 2, will signal whenever automatic pump deaeration is active.

FlowControlEnable

When the FlowControl function is enabled, various faults and deviations related to the dosing process will be detected and indicated.

0:	FlowControl function disabled.
1:	FlowControl function enabled.

The enabling/disabling of FlowControl means the enabling/disabling of all alarms/warnings that are associated with flow measurement. See section *7.7 Measurement data modules*.

If the FlowControl function is disabled, the AutoFlowAdapt function (see control bits AutoFlowAdaptEnable) cannot be enabled.

ProfiWatchdogEnable

The PROFIBUS/PROFINET software watchdog is used to monitor the PROFIBUS/PROFINET connection. If the connection is broken, the DDA pump will stop dosing and indicate a bus communication fault. See section *7.8 Alarms and warning*.

0:	PROFIBUS/PROFINET software watchdog disabled.
1:	PROFIBUS/PROFINET software watchdog enabled.

When "Bus control" is selected via the pump HMI, the PROFIBUS/PROFINET watchdog is automatically enabled every time the pump is powered on. If the bus communication is somehow interrupted (no communication with a PROFIBUS/PROFINET master), this will be detected and the DDA pump will stop with an alarm indicating "bus error" (event code 15).

Enabling of PROFIBUS/PROFINET will at the same time automatically enable the monitoring of the cable connection from the E-box to the DDA pump (event code 152).

After power-on, the PROFIBUS/PROFINET master can at any time control the enabling and disabling of the PROFIBUS/PROFINET software watchdog. The monitoring of the E-box cable connection will follow this choice.

When "Bus control" is disabled via the pump HMI, the PROFIBUS/PROFINET software watchdog is also automatically disabled and so is the monitoring of the E-box connection.

AutoFlowAdaptEnable

The AutoFlowAdapt function detects changes in various parameters and responds accordingly to keep the flow constant. Dosing accuracy is increased when this function is enabled.

0:	AutoFlowAdapt function disabled.
1:	AutoFlowAdapt function enabled.

The AutoFlowAdapt function can only be enabled if the FlowControl function is also enabled.

PulseMemoryEnable

The Pulse memory function can be used in operating mode "Pulse". When it is enabled, up to 65000 unprocessed pulses can be saved for subsequent processing.

0:	Pulse memory function disabled.
1:	Pulse memory function enabled.

ResetFault

When this control bit is toggled 0 → 1, the pump will attempt to reset pending alarms and warnings and to restart the pump if it was stopped due to an alarm.

Pulse

When this control bit is toggled 0 → 1, a pulse signal is sent to the pump. This can be used in operating modes "Pulse" and "Batch" and is equivalent to a pulse signal from the signal inputs.

ResetVolumeCounter

When this control bit is toggled 0 → 1, VolumeTripCounter (module 30) is reset to "0".

SetRTC

When this control bit is toggled 0 → 1, the internal real-time clock (RTC) in the DDA pump will be updated. The values must have been previously written to SetDataTime (module 9).

7.2.2 Explanation to control mode

Control enumeration for remote start/stop of the pump.

Value	Name
0	ReqStart If the pump is ready to be controlled from PROFIBUS/ PROFINET (StatusModule: ActRemoteAccess = "1"), this value will start the pump and it will start dosing according to the selected operating mode. If the pump is stopped via the pump HMI, it will restart when ▶/■ is pressed.
1	ReqStop If the pump is ready to be controlled from PROFIBUS/ PROFINET (StatusModule: ActRemoteAccess = "1"), this value will stop the pump and the pump HMI will show ❚❚. If the pump is stopped from the bus, it cannot be started via the pump HMI (unless "Bus control" is deselected). ReqStop cannot stop the pump when it is deaerating.

7.2.3 Explanation to operating mode

Control enumeration for selection of operating mode.

Value	Name
0	**Manual** In this operating mode, the pump constantly doses the dosing flow set via SetpointManual (module 2) or the pump HMI.
1	**Pulse** In this operating mode, the pump doses the volume set via SetPulseVolume (module 3) or the pump HMI for each incoming pulse. Reception of the Pulse command from PROFIBUS/PROFINET has the same effect as an incoming contact pulse signal. The remaining pulse volume during dosing can be read from RemainingDosingVolume (module 28). If the pump receives more pulses than it can process at the maximum dosing flow, excess pulses will be ignored if the Memory function (PulseMemoryEnable bit) is not enabled.
2	**Analog** In this operating mode, the pump doses according to the external analog signal. It can operate according to a 4-20 mA or 0-20 mA signal selected via the AnalogMode bit or the pump HMI. If the input value in Analog mode 4-20 mA falls below 2 mA, an alarm is displayed and the pump stops. The relation between analog signal and dosing value is called analog scaling and must be set via the pump HMI.
3	**Timer** In this operating mode, the pump doses the volume set via SetBatchDosingVolume (module 4) over a time period of SetBatchDosingTime (module 5). The remaining batch volume during dosing can be read from RemainingDosingVolume (module 28). The time the dosing should take place is controlled by a cyclic timer or by week timers. The selection is done via the TimerMode bit or the pump HMI. Some other parameters are related to timer dosing. They can only be programmed via the pump HMI.
4	**Batch** In this operating mode, the pump doses the volume set via SetBatchDosingVolume (module 4) over a time period of SetBatchDosingTime (module 5) for each incoming pulse (or PROFIBUS/PROFINET Pulse command). The remaining batch volume during dosing can be read from RemainingDosingVolume (module 28). If the pump receives more pulses than it can process at the maximum dosing flow, excess pulses will be ignored if the memory function (PulseMemoryEnable bit) is not enabled.

7.3 Dosing settings

Module	Name	Data type	Unit	Description
2	SetSetpointManual	8	l/h	Setting of the setpoint used in operating mode "Manual". Can also be set via the pump HMI. The present value can always be read from ActSetpointManual (module 12).
3	SetPulseVolume	8	l	Setting of the pulse volume used in operating mode "Pulse". Can also be set via the pump HMI. The present value can always be read from ActPulseVolume (module 13).
4	SetBatchDosingVolume	8	l	Setting of the batch dosing volume used in operating mode "Batch". Can also be set via the pump HMI. The present value can always be read from ActBatchDosingVolume (module 14).
5	SetBatchDosingTime	7	0.1 s	Setting of the batch dosing time used in operating mode "Batch". Can also be set via the pump HMI. The present value can always be read from ActBatchDosingTime (module 15).
6	SetPressureMax	8	bar	Setting of the (relative) pressure alarm limit. Can also be set via the pump HMI. The present value can always be read from ActPressureMax (module 16).

7.4 Other settings

Module	Name	Data type	Unit	Description
7	SetOutputRelays	5	bits	Used to enable and disable the output relays 1 and 2. A relay has to be set to "Bus control" via the pump HMI if it should be controllable from the bus via the SetOutputRelays module. Via the pump HMI, the relays can also be individually configured to be of type NO or NC. Bit 0: Relay 1 control: 0: Not active 1: Active. Bit 1: Relay 2 control: 0: Not active 1: Active. The present status of the output relays can always be read from OutputRelays (module 34).
8	SetAnalogOutput	8	A	Used to control the analog output signal. The type of signal (4-20 mA or 0-20 mA) follows the setting of the AnalogMode bit. The analog output has to be set to "Bus control" via the pump HMI if it should be controllable from the bus. The present value of the analog output signal can always be read from AnalogOutput (module 32).
9	SetDateTime	10	BCD string	Used to set the internal real-time clock (RTC). Byte 1: Year (from year 2000) Byte 2: Month [1-12] Byte 3: Day [1-31] Byte 4: Hour [0-23] Byte 5: Minute [0-59] Byte 6: Second [0-59]. Each byte is a binary-coded decimal (BCD) value. **Example** 15:38:00, April 24 2011, is coded with hexadecimal numbers as: Year = 11h, Month = 04h, Day = 24h, Hour = 15h, Minute = 38h, Second = 00h. Can also be set via the pump HMI. The present value of the real-time clock can always be read from DateTime (module 21).

7.5 Bus settings compared to pump HMI settings

Name	Selectable from HMI	Setting preserved during power-off
Mode/state settings		
RemoteAccessReq	No	Yes
Deaerating (100 %)	Yes	Yes/No*
AnalogMode	Yes	Yes
TimerMode	Yes	Yes
SlowMode	Yes	Yes
Velocity	Yes	Yes
Enable/disable function		
AutoDeaeratingEnable	Yes	Yes
FlowControlEnable	Yes	Yes
ProfiWatchdogEnable	Yes**	Yes
AutoFlowAdaptEnable	Yes	Yes
PulseMemoryEnable	Yes	Yes
Action commands		
ResetFault	Yes	-
Pulse	No	-
ResetVolumeCounter	Yes	-
SetRTC	Yes	-
Operation control		
ReqStart	Yes	Yes
ReqStop	Yes	No
OperatingMode	Yes	Yes
Dosing settings		
SetpointManual	Yes	Yes
SetPulseVolume	Yes	Yes
SetBatchDosingVolume	Yes	Yes
SetBatchDosingTime	Yes	Yes
SetFlowControlPressMax	Yes	Yes
Output signal control		
SetOutputRelay (value)	No	Yes
SetAnalogOutput (value)	No	Yes
SetDateTime	Yes	Yes

* Deaerating will be preserved if commanded from bus.

** Selecting and deselecting "Bus control" will implicitly enable and disable the PROFIBUS/PROFINET watchdog and the monitoring of the E-box connection to the DDA pump.

7.6 Status module (StatusModule, module 11)

This is a PROFIBUS/PROFINET input module used for the status of the DDA pump settings. Its data type is 10, non-standard. The actual status of all the pump modes and states are reflected, no matter if it is a result of a pump HMI setting or a setting written from PROFIBUS/PROFINET via ControlModule (module 1).

Byte 1 (data type 5)	Actual mode/state settings [bits]	
	Bit	**Name**
	0	ActRemoteAccess
	1	ActDeaerating (100 %)
	2	ActAnalogMode
	3	ActTimerMode
	4	ActSlowMode
	5	ActVelocity
	6-7	-
Byte 2 (data type 5)	Actual enable/disable function [bits]	
	Bit	**Name**
	0	ActAutoDeaeratingEnable
	1	ActFlowControlEnable
	2	ActProfiWatchdogEnable
	3	ActAutoFlowAdaptEnable
	4	ActPulseMemoryEnable
	5-7	-
Byte 3 (data type 5)	Action command acknowledgement [bits]	
	Bit	**Name**
	0	ResetFaultAck
	1	PulseAck
	2	ResetVolumeCounterAck
	3	SetRTCAck
	4-7	-
Byte 4 (data type 5)	Miscellaneous status [bits]	
	Bit	**Name**
	0	Dosing (running)
	1	Warning
	2	Fault
	3	BusControlLocallyEnabled
	4-7	-
Byte 5 (data type 5)	ActualStartStop [enumeration]	
	Value	**Name**
	0	Started
	1	Stopped
	2	Calibratin g
	3	Service
	4-255	-
Byte 6 (data type 5)	ActualOperatingMode [enumeration]	
	Value	**Name**
	0	Manual
	1	Pulse
	2	Analog
	3	Timer
	4	Batch
	5-255	-

7.6.1 Explanation to status bits

ActRemoteAccess

Status bit indicating whether the pump is in a state where it is controllable from the bus.

0:	The pump can only be controlled from its HMI and its external signal inputs. In this state, all control bits in ControlModule and writing to any output module will have no influence.
1:	In this state, the pump can be controlled by the bit settings in the ControlModule (as well as from the pump HMI and external signal inputs) and the writing to the other output modules. To enter this state, the ControlModule bit 0 must be set and the pump must be started via the pump HMI by pressing ▶/■.

ActDeaerating

Status bit indicating whether the pump is deaerating or not.

0:	The pump is not deaerating.
1:	The pump is deaerating.

ActAnalogMode

Status bit indicating the selected type of the analog input signal.

0:	0-20 mA.
1:	4-20 mA. This will always be the reading if the operating mode is not "Analog".

ActTimerMode

Status bit indicating the selected timer mode.

0:	Cycle timer mode.
1:	Week timer mode.

ActSlowMode

Status bit indicating whether SlowMode has been enabled.

0:	SlowMode disabled. No slow-down of suction stroke velocity.
1:	SlowMode enabled. Slows down the suction stroke velocity to the velocity selected with control bit Velocity.

Velocity

Status bit indicating the selected SlowMode suction stroke velocity.

0:	Selected SlowMode velocity 50 %. This will always be the reading if SlowMode is disabled.
1:	Selected SlowMode velocity 25 %.

ActAutoDeaeratingEnable

Status bit indicating whether automatic pump deaeration has been enabled.

0:	Automatic pump deaeration disabled.
1:	Automatic pump deaeration enabled. DigitalOutputs (module 34), bit 2, will signal whenever the automatic pump deaeration is active.

ActFlowControlEnable

Status bit indicating whether the FlowControl function has been enabled.

0:	FlowControl function disabled.
1:	FlowControl function enabled.

ActProfiWatchdogEnable

Status bit indicating whether the PROFIBUS/PROFINET software watchdog has been enabled.

0:	PROFIBUS/PROFINET software watchdog disabled.
1:	PROFIBUS/PROFINET software watchdog enabled.

The PROFIBUS/PROFINET software watchdog is automatically enabled/disabled when "Bus control" is selected/deselected via the pump HMI. The software watchdog can be enabled/disabled independently via the bus.

ActAutoFlowAdaptEnable

Status bit indicating whether the AutoFlowAdapt function has been enabled.

0:	AutoFlowAdapt function disabled. This will always be the reading if the FlowControl function is disabled.
1:	AutoFlowAdapt function enabled.

ActPulseMemoryEnable

Status bit indicating whether the Pulse memory function is enabled.

0:	Pulse memory function disabled.
1:	Pulse memory function enabled.

Dosing (running)

Status bit indicating whether the DDA pump is dosing (running) at the moment.

0:	The pump is not dosing at the moment.
1:	The pump is dosing at the moment.

Warning

Warning status bit.

0:	No warning is present.
1:	A warning is present. The pump can however continue its precise dosing for the time being, but service is recommended.

For further details about possible warnings and faults as well as the pump behaviour in these situations, see section *7.8 Alarms and warning*.

Fault

Fault status bit. The pump will stop dosing as long as the fault is present.

0:	No fault is present.
1:	A fault is present, and the pump will remain stopped until the fault has been corrected.

For further details about possible warnings and faults as well as the pump behaviour in these situations, see section *7.8 Alarms and warning*.

BusControlLocallyEnabled

Status bit indicating whether "Bus control" has been enabled in the Settings menu on the pump HMI.

0:	Bus control has not been enabled via the pump HMI. Setting of the RemoteAccess bit in ControlModule has no effect.
1:	Bus control has been enabled via the pump HMI.

7.6.2 Explanation to command acknowledge bits

If the ActRemoteAccess bit is not set, PROFIBUS/PROFINET commands (and writings in general) will be prohibited and none of the acknowledge bits will ever be set. Command acknowledge bits can thus be used to check whether a command from ControlModule was sent or not.

ResetFaultAck

Acknowledge bit belonging to the ResetFault control bit. It will be set when the control bit is set and the command has been executed. It will be cleared when the control bit is cleared.

PulseAck

Acknowledge bit belonging to the Pulse control bit. It will be set when the control bit is set and the command has been executed. It will be cleared when the control bit is cleared.

ResetVolumeCounterAck

Acknowledge bit belonging to the ResetVolumeCounter control bit. It will be set when the control bit is set and the command has been executed. It will be cleared when the control bit is cleared.

SetRTCAck

Acknowledge bit belonging to the SetRTC control bit. It will be set when the control bit is set and the command has been executed. It will be cleared when the control bit is cleared.

Explanation to ActualStartStop

Status enumeration for reading whether the pump is started, stopped, calibrating or in service mode:

Value	Name
0	**Started** This has the following meaning for the different operating modes: • "Manual": The pump will be dosing according to ActualSetpointManual (module 12). • "Analog": The pump will be dosing according to the analog input signal and the analog scaling. • "Pulse": The pump will be dosing according to the reception of pulses and the value of ActualPulseVolume (module 13). • "Batch": The pump will be dosing according to the reception of pulses and the values of ActualBatchDosingVolume (module 14) and ActualBatchDosingTime (module 15). • "Timer": The pump will be dosing according to the timer functions using the batch dosing settings.
1	**Stopped** The pump has been stopped by one of the control sources. The state of the control sources can be read from ControlSourceStates (module 17).
2	**Calibrating** The pump is calibrating the dosing accuracy. This is only possible via the pump HMI by selecting Calibration in the Setup menu.
3	**Service** The pump has stopped and has been brought into Service mode. This is only possible via the pump HMI and can be done by pressing ▶/■ and 100% simultaneously.

7.6.3 Explanation to ActualOperatingMode

Status enumeration for reading of the actual operating mode. For an explanation of these modes and the belonging enumeration, see section *7.2.3 Explanation to operating mode*.

7.7 Measurement data modules

Module	Name	Data type	Unit	Description
12	ActualSetpointManual	8	l/h	The actual setpoint used in operating mode "Manual". Can be set via SetpointManual (module 2) or via the pump HMI.
13	ActualPulseVolume	8	l	The actual pulse volume used in operating mode "Pulse". Can be set via SetPulseVolume (module 3) or via the pump HMI.
14	ActualBatchDosingVolume	8	l	The actual batch dosing volume used in operating mode "Batch". Can be set via SetBatchDosingVolume (module 4) or via the pump HMI.
15	ActualBatchDosingTime	7	0.1 s	The actual batch dosing time used in operating mode "Batch". Can be set via SetBatchDosingTime (module 5) or via the pump HMI.
16	ActualPressureMax	8	bar	Actual value of (relative) pressure alarm limit setting. Can be set via SetPressureMax (module 6) or via the pump HMI.
17	ControlSourceStates	5	bits	Status of start/stop control sources, "1" means "Active". They can be active simultaneously. Bit 0: Stop via pump HMI Bit 1: External stop Bit 2: Stop from bus.
18	FaultCode	5	enum	See section *7.6 Status module (StatusModule, module 11)*.
19	WarningCode	5	enum	
20	WarningBits	6	bits	
21	DateTime	10	BCD string	Present value of the internal real-time clock (RTC). Can be set via SetDateTime (module 9) or via the pump HMI. Byte 1: Year (from year 2000) Byte 2: Month [1-12] Byte 3: Day [1-31] Byte 4: Hour [0-23] Byte 5: Minute [0-59] Byte 6: Second [0-59]. Each byte is a binary-coded decimal (BCD) value. **Example** 15:38:00, April 24 2011, is coded with hexadecimal numbers as: Year = 11h, Month = 04h, Day = 24h, Hour = 15h, Minute = 38h, Second = 00h.
22	DosingPressureMax	8	bar	Maximum dosing pressure, fixed factory-set value for this pump type.
23	DosingCapacityMax	8	l/h	Maximum dosing capacity, fixed factory-set value for this pump type.
24	DosingCapacityReference	8	l/h	The dosing capacity setpoint shown in the pump display. It represents the actual setpoint belonging to the actual operating mode and dosing state.
25	MeasuredDosingCapacity	8	l/h	Measured (actual) dosing capacity. FlowControl bit in ControlModule (module 1) must be enabled for this value to be available.
26	MeasuredPressure	8	bar	Measured absolute pressure. FlowControl bit in ControlModule must be enabled. Except for the atmospheric pressure, it corresponds to "Backpressure" reading in the display.
27	PulseInputFrequency	8	Hz	Frequency of pulse input (external pulse input signal or PROFIBUS/PROFINET Pulse command in ControlModule).
28	RemainingDosingVolume	8	l	Actual remaining volume to be dosed. Used in "Batch" mode.
29	VolumeTotal	8	l	Total volume dosed (non-resettable).
30	VolumeTripCounter	8	l	Dosed-volume trip counter (reset with ResetVolumeCounter command in ControlModule).
31	AnalogInput	8	A	Analog input signal 0-20 mA or 4-20 mA (used as setpoint in Analog mode).
32	AnalogOutput	8	A	Analog output signal. The parameter to map to the output is selected via the pump HMI. If control from PROFIBUS/PROFINET is selected, the analog output signal will be controlled from SetAnalogOutput (module 8).

Module	Name	Data type	Unit	Description
33	DigitalInputs	5	bits	Status of the external digital inputs. Logical "0": The input is not active. Logical "1": The input is active. The relay input type (NO or NC) is selected via the pump HMI. Signals are fixed to the following: Bit 0: Low-level signal Bit 1: Empty signal Bit 2: External stop.
34	OutputRelays	5	bits	Status of the two output relays. Logical "0": The output is not active. Logical "1": The output is active. The relay output type (NO or NC) is selected via the pump HMI. The output relay modules are defined as follows: Bit 0: Relay 1 (select signal parameter via the pump HMI). Bit 1: Relay 2 (select signal parameter via the pump HMI). Bit 2: Auto-deaerating (deaerating valve open). If "Bus control" has been selected as the relay signal parameter, the relay can be controlled from SetOutputRelays (module 7).
35	NumberOfPowerOns	6	-	Counts the number of times the pump has been powered on (non-resettable).
36	RunTime	7	s	Counts the time the DDA pump has been dosing (non-resettable).
37	OperatingHours	7	s	Counts the number of hours the DDA pump has been switched on. It counts both when the pump is dosing and when it is not dosing.
38	StrokeCounter	7	-	Counts the number of strokes (non-resettable).
39	TimeToNextDosing	7	s	Time before the next dosing takes place (only in timer mode).

7.8 Alarms and warning

Module	Name	Data type	Description
18	FaultCode	5	Code for active pump alarm. See event code in the table below.
19	WarningCode	5	Code for first active pump warning. See event code in the table below.
20	WarningBits	6	All active warnings. The belonging event code in parenthesis. **Byte 1** Bit 0: Backpressure low (211)* Bit 1: Air bubbles (35)* Bit 2: Cavitation (208)* Bit 3: Discharge valve leakage (36)* Bit 4: Suction valve leakage (37)* Bit 5: -- reserved -- Bit 6: Service now (12) Bit 7: Service soon (33) **Byte 2** Bit 0: Low level in tank (206) Bit 1: -- reserved -- Bit 2: FlowControl cable breakdown (169)* Bit 3: - Bit 4: - Bit 5: Flow deviation (17)* Bit 6: - Bit 7: -

* Requires FlowControlEnable bit in ControlModule to be set.

In case of a pump alarm or pump warning the modules WarningCode and FaultCode will contain an event code for the cause of the problem.

The complete list of possible alarm/warning codes from a DDA pump is shown in the table below.

Alarm events will make the pump stop. Some of them require acknowledgement of the alarm before the pump can be restarted. This acknowledgement can come from the pump HMI or PROFIBUS/PROFINET by usage of the ResetFault command.

The pump can only indicate one active alarm at a time, whereas there can be many simultaneously active warnings. The complete status of warnings can be read from the WarningBits module.

Event code	Event group	Event description	Depends on FlowControl enabled	Event action	Auto-acknowledge
210	Pump head	Maximum pressure limit exceeded. ActualPressureMax (module 16).	Yes	Alarm	Yes
211	Pump head	Backpressure too low. Fixed low-pressure limit (1.5 bar).	Yes	Alarm/ Warning[1)]	Yes
35	Pump head	Air bubbles, gas in pump head, deaerating problem.	Yes	Warning	Yes
208	Pump head	Cavitation.	Yes	Warning	Yes
36	Pump head	Discharge (pressure) valve leakage.	Yes	Warning	Yes
37	Pump head	Suction valve leakage.	Yes	Warning	Yes
12	Pump head	Service now (time for service exceeded).	No	Warning	No
33	Pump head	Soon time for service (general service information).	No	Warning	No
17	Pump head	Flow deviation (performance requirement not met).	Yes	Warning	Yes
51	Pump head	Blocked motor/pump.	No	Alarm	Yes
206	Tank	Low level in tank.	No	Warning	Yes
57	Tank	Empty tank (dry running).	No	Alarm	Yes
169	Input signals	Cable breakdown on FlowControl.	Yes	Warning	Yes
47	Input signals	Defective analog 4-20 mA cable.	No	Alarm	Yes
15	Communication	PROFIBUS/PROFINET communication fault (main network communication fault).	No	Alarm[2)]	No
152	Communication	Extension box communication fault (GENIbus communication fault). Defective cable between E-box and DDA pump.	No	Alarm[2)]	No

1) Warning or alarm is selected in the Settings menu via the pump HMI.

2) An alarm only occurs when the ActProfiWatchdogEnable bit has been set.
See sections *7.2.1 Explanation to control bits in ControlModule* and *7.6.1 Explanation to status bits*.

7.9 Device identification (DeviceIdentification, module 40)

The data type is 10, non-standard.

Byte	Name/description	
1	**UnitFamily [enumeration]**	**UnitType [enumeration]**
	1: UPE/MAGNA circulator pump	5: UPE, 3-phase 7: MAGNA, 1-phase 9: MAGNA, 1-phase, small 10: MAGNA3
	2: E-pump, 1-phase/3-phase, based on MGE motor or CUE frequency converter	2: MGE, 1-phase 3: MGE, 3-phase 4: MGE, 3-phase, large 5: CUE frequency converter 6: MGE, 3-phase, model G 7: MGE, 3-phase, model H/I
	7: MP 204 motor protector	1: MP 204
	17: Hydro Multi-E model G and earlier models	1: With 3-phase pumps 2: With 1-phase pumps
	21: Hydro MPC/Control MPC, Hydro Multi-B	1: Hydro MPC/Control MPC, CU 351 2: Hydro Multi-B, CU 323
	25: CR Monitor	1: CR Monitor, CU 351
	26: Dedicated Controls	1: Dedicated Controls, CU 361
	30: Smart Digital Dosing, DDA	1: Smart Digital Dosing, DDA
	39: Hydro Multi-E model H and later models	1: With 3-phase pumps 2: With 1-phase pumps
2	UnitType [enumeration] According to description above.	
3	UnitVersion [enumeration] Used by Grundfos.	
4	CIMSoftwareVersion [number]	
5	CIMSoftwareRevision [number]	
6	CIMModel [enumeration]	

8. Product simulation

The CIM module can be put in product simulation mode in which case it will generate life-like simulated values of all the PROFIBUS/PROFINET input data modules.

It will thus be possible to connect a PROFIBUS/PROFINET master to a CIM 150/CIM 500 without this device being connected to a real pump in a real-life system. In an office environment, it can then be verified that communication works and data is being received and handled correctly by the PROFIBUS/PROFINET master application program (e.g. PLC program) before the equipment is installed under real-life conditions.

8.1 CIM 150 product simulation

Product simulation mode is entered when the hexadecimal address switch has one of the values shown in the table below:

Address setting (section *5.4*)		**Simulated product**
SW3	SW4	
F	0	Pump profile
F	1	Booster system profile
F	2	CR Monitor profile
F	3	MP 204 motor protector profile
F	4	Digital Dosing DDA profile
F	5	Wastewater system profile

The effective address will be 15 (0x0F).

Only input modules are simulated. The data read has dummy values and no real product functionality is simulated.

8.2 CIM 500 Product Simulation

Product simulation mode is entered via the web server.
See section *A.4 PROFINET IO configuration* on page 29.

9. Fault finding

9.1 Fault finding CIM 150

Faults in a CIM 150 PROFIBUS module can be detected by observing the status of the two communication LEDs. See the table below.

9.1.1 LED status

Fault (LED status)	Possible cause	Remedy
1. Both LEDs (LED1 and LED2) remain off when the power supply is connected.	a) The CIM 150 is fitted incorrectly in the DDA pump.	Check that the CIM 150 is fitted / connected correctly.
	b) The CIM 150 is defective.	Replace the CIM 150.
2. The LED for internal communication (LED2) is flashing red.	a) No internal communication between the CIM 150 and the DDA pump.	Check that the CIM 150 is fitted correctly in the DDA pump.
3. The LED for internal communication (LED2) is constantly red.	a) The CIM 150 does not support the connected DDA pump.	Contact the nearest Grundfos company.
4. The PROFIBUS LED (LED1) is constantly red.	a) Fault in the CIM 150.	Contact the nearest Grundfos company.
5. The PROFIBUS LED (LED1) is flashing red.	a) Fault in the CIM 150 PROFIBUS configuration.	• Check that the PROFIBUS address (switches SW3 and SW4) has a valid value [1-126]. See section *5.4 Setting the PROFIBUS address*. • Check that the GSD file used is correct. • Check that the PROFIBUS cable has been fitted correctly. See section *5.3 Connecting the PROFIBUS*. • Check that the PROFIBUS termination is correct. See section *5.5 Termination resistors*.

9.2 Fault finding CIM 500

Faults in the CIM 500 can be detected by observing the status of the two communication LEDs. See the table below and section *4.3 CIM 500 PROFINET IO*.

9.2.1 LED status

Fault (LED status)	Possible cause	Remedy
1. Both LEDs (LED1 and LED2) remain off when the power supply is connected.	a) The CIM 500 is fitted incorrectly in the Grundfos product.	Check that the CIM 500 is fitted/connected correctly.
	b) The CIM 500 is defective.	Replace the CIM 500.
2. The PROFINET IO LED (LED1) remains off.	a) The protocol selection switch (SW1) has been set in Modbus TCP position	Set the switch to "0".
3. The LED for internal communication (LED2) is flashing red.	a) No internal communication between the CIM 500 and the Grundfos product.	Check that the CIM 500 is fitted correctly in the Grundfos product.
4. The LED for internal communication (LED2) is permanently red.	a) The CIM 500 does not support the Grundfos product connected.	Contact the nearest Grundfos company.
5. The PROFINET IO LED (LED1) is permanently red.	a) Connected Grundfos product is not supported.	Contact the nearest Grundfos company.
	b) Illegal position of protocol switch (SW1)	Check that the rotary switch SW1 is set to "0".
6. The PROFINET IO (LED1) is flashing red.	a) Fault in the CIM 500 PROFINET IO configuration.	• Check that the right GSDML file is used. Check that PROFINET IO IP address configuration is correct. See section *A.4 PROFINET IO configuration* on page 29. • Check device name in the CIM 500 and PROFINET IO master.
7. The PROFINET IO (LED1) is pulsing red.	a) Connection to master lost.	• Check cables. • Check master is running.
8. LED1 is permanently red and green at the same time.	a) Error in firmware download.	Use the web server to download the firmware again. See section *A.2 Web server configuration* on page 28.
9. LED2 is permanently red and green at the same time.	a) Memory fault.	Replace the CIM 500.

10. Grundfos alarm and warning codes

This is a complete list of alarm and warning codes for Grundfos products. For the codes supported by DDA pumps, see section *7.8 Alarms and warning*.

Code	Description	Code	Description	Code	Description
1	Leakage current	32	Overvoltage	72	Hardware fault, type 1
2	Missing phase	33	Soon time for service (general service information)	73	Hardware shutdown (HSD)
3	External fault signal	35	Gas in pump head, deaerating problem	74	Internal supply voltage too high
4	Too many restarts	36	Discharge valve leakage	75	Internal supply voltage too low
5	Regenerative braking	37	Suction valve leakage	76	Internal communication fault
6	Mains fault	38	Vent valve defective	77	Communication fault, twin-head pump
7	Too many hardware shutdowns	40	Undervoltage	78	Fault, speed plug
8	PWM switching frequency reduced	41	Undervoltage transient	79	Functional fault, add-on module
9	Phase sequence reversal	42	Cut-in fault (dV/dt)	80	Hardware fault, type 2
10	Communication fault, pump	45	Voltage asymmetry	81	Verification error, data area (RAM)
11	Water-in-oil fault (motor oil)	48	Overload	82	Verification error, code area (ROM, FLASH)
12	Time for service (general service information)	49	Overcurrent (i_line, i_dc, i_mo)	83	Verification error, FE parameter area (EEPROM)
13	Moisture alarm, analog	50	Motor protection function, general shutdown (MPF)	84	Memory access error
14	Electronic DC-link protection activated (ERP)	51	Blocked motor/pump	85	Verification error, BE parameter area (EEPROM)
15	Communication fault, main system (SCADA)	52	Motor slip high	88	Sensor fault
16	Other	53	Stalled motor	89	Signal fault, (feedback) sensor 1
17	Performance requirement cannot be met	54	Motor protection function, 3 sec. limit	90	Signal fault, speed sensor
18	Commanded alarm standby (trip)	55	Motor current protection activated (MCP)	91	Signal fault, temperature 1 sensor
19	Diaphragm break (dosing pump)	56	Underload	92	Calibration fault, (feedback) sensor
20	Insulation resistance low	57	Dry running	93	Signal fault, sensor 2
21	Too many starts per hour	58	Low flow	94	Limit exceeded, sensor 1
22	Moisture switch alarm, digital	59	No flow	95	Limit exceeded, sensor 2
23	Smart trim gap alarm	60	Low input power	96	Setpoint signal outside range
24	Vibration	64	Overtemperature	97	Signal fault, setpoint input
25	Setup conflict	65	Motor temperature 1 (t_m or t_mo or t_mo1)	98	Signal fault, input for setpoint influence
26	Load continues even if the motor has been switched off	66	Temperature, control electronics (t_e)	99	Signal fault, input for analog setpoint
27	External motor protector activated (e.g. MP 204)	67	Temperature too high, internal frequency converter module (t_m)	104	Software shutdown
28	Battery low	68	External temperature/water temperature (t_w)	105	Electronic rectifier protection activated (ERP)
29	Turbine operation (impellers forced backwards)	69	Thermal relay 1 in motor (e.g. Klixon)	106	Electronic inverter protection activated (EIP)
30	Change bearings (specific service information)	70	Thermal relay 2 in motor (e.g. thermistor)	110	Skew load, electrical asymmetry
31	Change varistor(s) (specific service information)	71	Motor temperature 2 (Pt100, t_mo2)	111	Current asymmetry

Code	Description	Code	Description	Code	Description
112	Cos φ too high	167	Signal fault, analog input 3	195	Limit exceeded, sensor 6
113	Cos φ too low	168	Signal fault, pressure sensor	196	Operation with reduced efficiency
120	Auxiliary winding fault (single-phase motors)	169	Signal fault, flow sensor	197	Operation with reduced pressure
121	Auxiliary winding current too high (single-phase motors)	170	Signal fault, water-in-oil (WIO) sensor	198	Operation with increased power consumption
122	Auxiliary winding current too low (single-phase motors)	171	Signal fault, moisture sensor	199	Process out of range (monitoring/ estimation/calculation/control)
123	Start capacitor, low (single-phase motors)	172	Signal fault, atmospheric pressure sensor	200	Application alarm
124	Run capacitor, low (single-phase motors)	173	Signal fault, rotor position sensor (Hall sensor)	201	External sensor input high
144	Motor temperature 3 (Pt100, t_mo3)	174	Signal fault, rotor origo sensor	202	External sensor input low
145	Bearing temperature high (Pt100), in general or top bearing	175	Signal fault, temperature 2 sensor (t_mo2)	203	Alarm on all pumps
146	Bearing temperature high (Pt100), middle bearing	176	Signal fault, temperature 3 sensor (t_mo3)	204	Inconsistency between sensors
147	Bearing temperature high (Pt100), bottom bearing	177	Signal fault, Smart trim gap sensor	205	Level float switch sequence inconsistency
148	Motor bearing temperature high (Pt100) in drive end (DE)	178	Signal fault, vibration sensor	206	Water shortage, level 1
149	Motor bearing temperature high (Pt100) in non-drive end (NDE)	179	Signal fault, bearing temperature sensor (Pt100), general or top bearing	207	Water leakage
152	Communication fault, add-on module	180	Signal fault, bearing temperature sensor (Pt100), middle bearing	208	Cavitation
153	Fault, analog output	181	Signal fault, PTC sensor (short-circuited)	209	Non-return valve fault
154	Communication fault, display	182	Signal fault, bearing temperature sensor (Pt100), bottom bearing	210	High pressure
155	Inrush fault	183	Signal fault, extra temperature sensor	211	Low pressure
156	Communication fault, internal frequency converter module	184	Signal fault, general-purpose sensor	212	Diaphragm tank precharge pressure out of range
157	Real-time clock out of order	185	Unknown sensor type	213	VFD not ready
158	Hardware circuit measurement fault	186	Signal fault, power meter sensor	214	Water shortage, level 2
159	CIM fault (Communication Interface Module)	187	Signal fault, energy meter	215	Soft pressure build-up timeout
160	GSM modem, SIM card fault	188	Signal fault, user-defined sensor	216	Pilot pump alarm
161	Sensor supply fault, 5 V	189	Signal fault, level sensor	217	Alarm, general-purpose sensor high
162	Sensor supply fault, 24 V	190	Limit exceeded, sensor 1 (e.g. alarm level in WW application)	218	Alarm, general-purpose sensor low
163	Measurement fault, motor protection	191	Limit exceeded, sensor 2 (e.g. high level in WW application)	219	Pressure relief not adequate
164	Signal fault, LiqTec sensor	192	Limit exceeded, sensor 3 (e.g. overflow level in WW application)	220	Fault, motor contactor feedback
165	Signal fault, analog input 1	193	Limit exceeded, sensor 4 (e.g. low level in WW/tank filling application	221	Fault, mixer contactor feedback
166	Signal fault, analog input 2	194	Limit exceeded, sensor 5	222	Time for service, mixer

Code	Description	Code	Description	Code	Description
223	Maximum number of mixer starts per hour exceeded	232	Ethernet: Auto-disabled due to misuse	241	Motor phase failure
224	Pump fault (due to auxiliary component or general fault)	233	Ethernet: IP address conflict	242	Automatic motor model recognition failed
225	Communication fault, pump module	234	Back-up pump alarm	243	Motor relay has been forced (manually operated/commanded)
226	Communication fault, I/O module	235	Gas detected	244	Fault, On/Off/Auto switch
227	Combi event	236	Pump 1 fault	245	Pump continuous runtime too long
228	User-defined event	237	Pump 2 fault	246	User-defined relay has been forced (manually operated/ commanded)
229	Water on floor	238	Pump 3 fault	247	Power-on notice (device/system has been switched off)
230	Network alarm	239	Pump 4 fault	248	Fault, battery/UPS
231	Ethernet: No IP address from DHCP server	240	Lubricate bearings (specific service information)		

11. PROFIBUS address

Decimal to hexidecimal conversion table for setting of the PROFIBUS address switches. See section *5.4 Setting the PROFIBUS address*.

PROFIBUS address	SW3	SW4
1	0	1
2	0	2
3	0	3
4	0	4
5	0	5
6	0	6
7	0	7
8	0	8
9	0	9
10	0	A
11	0	B
12	0	C
13	0	D
14	0	E
15	0	F
16	1	0
17	1	1
18	1	2
19	1	3
20	1	4
21	1	5
22	1	6
23	1	7
24	1	8
25	1	9
26	1	A
27	1	B
28	1	C
29	1	D
30	1	E
31	1	F
32	2	0
33	2	1
34	2	2
35	2	3
36	2	4
37	2	5
38	2	6
39	2	7
40	2	8
41	2	9
42	2	A
43	2	B
44	2	C
45	2	D

PROFIBUS address	SW3	SW4
46	2	E
47	2	F
48	3	0
49	3	1
50	3	2
51	3	3
52	3	4
53	3	5
54	3	6
55	3	7
56	3	8
57	3	9
58	3	A
59	3	B
60	3	C
61	3	D
62	3	E
63	3	F
64	4	0
65	4	1
66	4	2
67	4	3
68	4	4
69	4	5
70	4	6
71	4	7
72	4	8
73	4	9
74	4	A
75	4	B
76	4	C
77	4	D
78	4	E
79	4	F
80	5	0
81	5	1
82	5	2
83	5	3
84	5	4
85	5	5
86	5	6
87	5	7
88	5	8
89	5	9
90	5	A

PROFIBUS address	SW3	SW4
91	5	B
92	5	C
93	5	D
94	5	E
95	5	F
96	6	0
97	6	1
98	6	2
99	6	3
100	6	4
101	6	5
102	6	6
103	6	7
104	6	8
105	6	9
106	6	A
107	6	B
108	6	C
109	6	D
110	6	E
111	6	F
112	7	0
113	7	1
114	7	2
115	7	3
116	7	4
117	7	5
118	7	6
119	7	7
120	7	8
121	7	9
122	7	A
123	7	B
124	7	C
125	7	D
126	7	E

Subject to alterations.

The appendix describes the parts of the CIM 500 web server needed for the configuration of a PROFINET IO Ethernet connection. For other CIM 500 web server features, not specifically related to PROFINET IO, see the CIM 500 Installation & Operating instructions.

A.1 How to configure an IP address on your PC

For connecting a PC to the CIM 500 via Ethernet, the PC must be set up to use a fixed (static) IP address belonging to the same subnetwork as the CIM 500.

1. Open "Control Panel".
2. Enter "Network and Sharing Center".
3. Click [Change adapter settings].
4. Right-click and select "Properties" for Ethernet adapter. Typically "Local Area Connection".
5. Select properties for "Internet Protocol Version 4(TCP/IPv4).
6. Select tab "Alternate Configuration".
7. Configure an IP address and subnet mask to be used by your PC. See fig. 11.

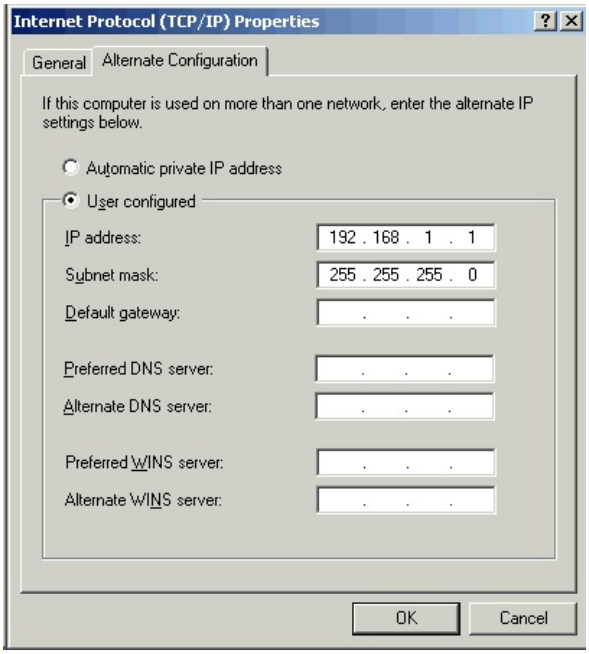


Fig. 11 Example from Windows XP

A.2 Web server configuration

The built-in web server is an easy and effective way to monitor the status of the CIM 500 module and configure the available functions and Industrial Ethernet protocols. The web server also makes it possible to update the firmware of the CIM module, and store/restore settings.

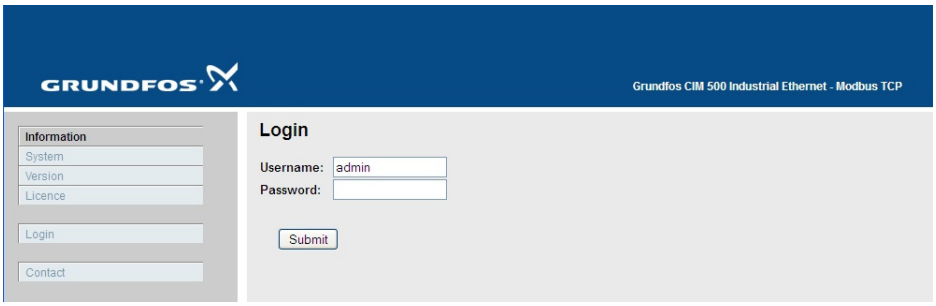
Before configuration

- Check that PC and CIM module are connected via an Ethernet cable.
- Check that the PC Ethernet port is set to the same network as the CIM module. For network configuration, see section *A.1 How to configure an IP address on your PC*.

To establish a connection from a PC to CIM 500 the first time, the following steps are required:

1. Open a standard Internet browser and type 192.168.1.100 in the URL address field.
2. Log in to the Web server.

A.3 Login



TM05 6063 4412

Fig. 12 Login

User name	Enter user name. Default: admin.
Password	Enter password. Default: Grundfos.

Note ***User name and password can be changed on the web server under "Grundfos Management"***

A.4 PROFINET IO configuration

This web page is used to configure all the parameters relevant to the PROFINET IO protocol standard. All settings can also be configured from a standard PROFINET IO configuration tool, for instance Siemens Primary Setup Tool (PST). It is available on internet.

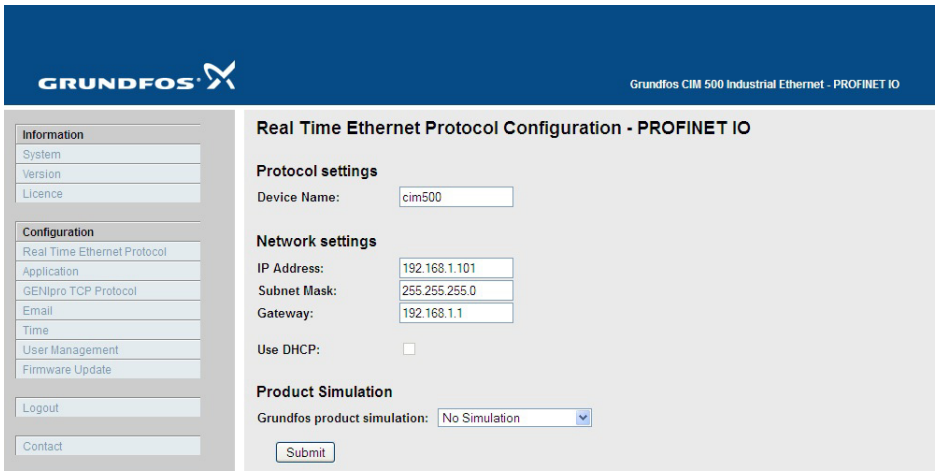


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Fig. 13 Real Time Ethernet Protocol Configuration - PROFINET IO

Object	Description
Device Name	The PROFINET IO device name. It must be unique.
IP Address	The static IP address for CIM 500 on the PROFINET IO network.
Subnet mask	Configure the subnet mask for the CIM 500 module on the PROFINET IO network.
Gateway	Configure the default gateway for the PROFINET IO network.
Use DHCP	The CIM 500 module can be configured to automatically obtain the IP address from a DHCP server on the network.
Grundfos product simulation	The CIM 500 can be put in product simulation mode to generate realistic simulated values of all the PROFINET IO input data modules. It will thus be possible to connect a PROFINET IO master to a CIM 500 fitted in a CIU or E-box without installing this device in a real industrial process system. In an office environment, it can then be verified that communication works and data are received and handled correctly by the PROFINET IO master application program (e.g. PLC program) before installing the device. To enable product simulation, select a product type from the drop down list. Product simulation will be terminated by a module power cycle.

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